AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A control device for generating a desired gait of a legged mobile robot that travels by moving a plurality of legs extended from its body and for controlling an operation of the robot so as to follow the desired gait, comprising:

slippage determining means for determining an occurrence of a slippage of the robot in operation, following the desired gait;

permissible range setting means for variably setting a permissible range of a restriction object amount according to a determination result of the slippage determining means, the restriction object amount being a horizontal component of a translational floor reaction force to be applied to the robot, or a component of the translational floor reaction force in parallel to a floor surface, or a horizontal component of a total center-of-gravity acceleration of the robot, or a component of the total center-of-gravity acceleration in parallel to a floor surface;

provisional motion determining means for determining a provisional motion of the desired gait such that a resultant force of a gravity and an inertial force acting on the robot on a predetermined dynamic model satisfies a predetermined dynamic balance condition; and

provisional motion correcting means for correcting the provisional motion to

determine the motion of a desired gait by changing a changing rate of an angular

momentum about the center-of-gravity of a robot from the provisional motion so as

to limit the restriction object amount to the permissible range while satisfying the

dynamic balance condition at the same time if the restriction object amount

determined by the provisional motion of the desired gait deviates from the

permissible range.

2. (Original) A control device for generating a desired gait of a legged mobile

robot that travels by moving a plurality of legs extended from its body and for

controlling an operation of the robot so as to follow the desired gait, comprising:

slippage determining means for determining an occurrence of a slippage of

the robot in operation, following the desired gait;

permissible range setting means for variably setting a permissible range of a

restriction object amount according to a determination result of the slippage

determining means, the restriction object amount being a vertical component of a

floor reaction force moment to be applied to the robot or a component of the floor

reaction force moment in the direction of a floor surface normal line or a vertical

component of a changing rate of angular momentum of the robot, or a component of

the changing rate of the angular momentum in the direction of floor surface normal

line;

provisional motion determining means for determining a provisional motion of

the desired gait such that a resultant force of a gravity and an inertial force acting on

the robot on a predetermined dynamic model satisfies a predetermined dynamic

balance condition; and

provisional motion correcting means for correcting the provisional motion to determine the motion of a desired gait by changing a changing rate of an angular momentum of the robot from the provisional motion so as to restrict the restriction object amount within the permissible range while satisfying the dynamic balance condition at the same time if the restriction object amount determined by the provisional motion of the desired gait deviates from the permissible range.

3. (Original) A control device of a legged mobile robot adapted to sequentially determine an instantaneous value of a desired motion of a legged mobile robot, which travels by moving legs extended from its body, by using a dynamic model that at least expresses a relationship between a motion of the robot and a floor reaction force, and also to control an operation of the robot at the same time so as to make the robot follow the determined instantaneous value of the desired motion, comprising:

slippage determining means for determining an occurrence of a slippage of the robot in operation, following the desired motion;

permissible range setting means for variably setting a permissible range of a restriction object amount according to a determination result of the slippage determining means, the restriction object amount being at least a horizontal component of a translational floor reaction force to be applied to the robot, or a component of the translational floor reaction force in parallel to a floor surface, or a horizontal component of a total center-of-gravity acceleration of the robot, or a component of the total center-of-gravity acceleration in parallel to a floor surface; and

desired instantaneous value determining means for determining, on the basis

of at least the difference between a desired state amount of a posture of the robot

that corresponds to the determined instantaneous value of the desired motion and

an actual state amount of the posture of the robot, a new instantaneous value of the

desired motion such that the restriction object amount determined on the basis of

the dynamic model in correspondence to the new instantaneous value falls within

the permissible range and the difference approximates zero.

4. (Original) A control device of a legged mobile robot adapted to

sequentially determine instantaneous values of a desired motion and a desired floor

reaction force of a legged mobile robot, which travels by moving legs extended from

its body, by using a dynamic model that expresses at least a relationship between a

motion of the robot and a floor reaction force, and also to control an operation of the

robot at the same time so as to make the robot follow the determined instantaneous

values of the desired motion and the desired floor reaction force, comprising:

slippage determining means for determining an occurrence of a slippage of

the robot in operation, following the desired motion and the desired floor reaction

force;

permissible range setting means for variably setting a permissible range of a

restriction object amount according to a determination result of the slippage

determining means, the restriction object amount being at least a horizontal

component of a translational floor reaction force to be applied to the robot, or a

component of the translational floor reaction force in parallel to a floor surface, or a

horizontal component of a total center-of-gravity acceleration of the robot, or a

component of the total center-of-gravity acceleration in parallel to a floor surface; and

desired instantaneous value determining means for determining, on the basis of at least the difference between a desired state amount of a posture of the robot that corresponds to the determined instantaneous values of the desired motion and the desired floor reaction force and an actual state amount of the posture of the robot, new instantaneous values of the desired motion and the desired floor reaction force such that the restriction object amount determined on the basis of the dynamic model in correspondence to the new instantaneous value of the desired motion falls within the permissible range and the difference approximates zero.

5. (Previously Presented) The control device of a legged mobile robot according to claim 1, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least the ground speed of a distal portion of a leg in contact with the ground.

6. (Previously Presented) The control device of a legged mobile robot according to claim 1, wherein the slippage determining means comprises means for determining, on the basis of at least a temporal changing rate of an actual floor reaction force acting on a leg in contact with the ground and the ground speed of a distal portion of the leg, an apparent spring constant of the leg and determines an occurrence of a slippage on the basis of at least the apparent spring constant.

7. (Previously Presented) The control device of a legged mobile robot

according to claim 1, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least a result obtained by passing an actual floor reaction force acting on a leg in contact with the ground through a band-pass filter having a frequency passing characteristic in a range near a predetermined frequency.

8. (Previously Presented) The control device of a legged mobile robot according to claim 2, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least the ground speed of a distal portion of a leg in contact with the ground.

9. (Previously Presented) The control device of a legged mobile robot according to claim 2, wherein the slippage determining means comprises means for determining, on the basis of at least a temporal changing rate of an actual floor reaction force acting on a leg in contact with the ground and the ground speed of a distal portion of the leg, an apparent spring constant of the leg and determines an occurrence of a slippage on the basis of at least the apparent spring constant.

10. (Previously Presented) The control device of a legged mobile robot according to claim 2, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least a result obtained by passing an actual floor reaction force acting on a leg in contact with the ground through a band-pass filter having a frequency passing characteristic in a range near a predetermined frequency.

11. (Previously Presented) The control device of a legged mobile robot according to claim 3, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least the ground speed of a distal portion of a leg in contact with the ground.

12. (Previously Presented) The control device of a legged mobile robot according to claim 3, wherein the slippage determining means comprises means for determining, on the basis of at least a temporal changing rate of an actual floor reaction force acting on a leg in contact with the ground and the ground speed of a distal portion of the leg, an apparent spring constant of the leg and determines an occurrence of a slippage on the basis of at least the apparent spring constant.

13. (Previously Presented) The control device of a legged mobile robot according to claim 3, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least a result obtained by passing an actual floor reaction force acting on a leg in contact with the ground through a band-pass filter having a frequency passing characteristic in a range near a predetermined frequency.

14. (Previously Presented) The control device of a legged mobile robot according to claim 4, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least the ground speed of a distal portion of a leg in contact with the ground.

15. (Previously Presented) The control device of a legged mobile robot according to claim 4, wherein the slippage determining means comprises means for determining, on the basis of at least a temporal changing rate of an actual floor reaction force acting on a leg in contact with the ground and the ground speed of a distal portion of the leg, an apparent spring constant of the leg and determines an occurrence of a slippage on the basis of at least the apparent spring constant.

16. (Previously Presented) The control device of a legged mobile robot according to claim 4, wherein the slippage determining means determines an occurrence of a slippage on the basis of at least a result obtained by passing an actual floor reaction force acting on a leg in contact with the ground through a band-pass filter having a frequency passing characteristic in a range near a predetermined frequency.